



Caltrans Division of Research,
Innovation and System Information

Research Results

Planning/
Policy/
Programming

FEBRUARY 2016

Project Title:

Pilot Study Investigating the Interaction and Effects for State Highway Pavements, Trucks, Freight, and Logistics

Task Number: 2603

Start Date: November 15, 2011

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Product Category: New or improved business practice, procedure, or process; processed data/database

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Analyzing How Road Roughness Affects Trucking and Freight

Data on the interaction of truck freight, vehicles, and pavement supports long-range planning, economic analysis, and pavement management and preservation

WHAT WAS THE NEED?

As a major gateway for shipped goods and a center for agricultural production, freight movement is crucial to the economy of California. Most of the state's freight is transported by trucks, affecting the condition and shortening the lifespan of the state's highway system. In turn, road conditions impact the freight industry. Deteriorating road quality increases vibrations, which can damage goods, require more vehicle maintenance, cause delays, and make it more difficult to comply with noise and emission regulations, ultimately translating to a higher cost of moving goods. Making informed decisions regarding the cost of managing and preserving the pavement network requires going beyond the pavement to include broader economic affects, such as how deteriorating road conditions affect the price of goods and California's economy and the general traveling public. As part of this multiphase study, data was needed to analyze how pavement, trucks, and freight interact as a system to, support more expansive cost-benefit analysis, and inform pavement policies and practices.

WHAT WAS OUR GOAL?

The goal was to collect data and information to enable economic assessment of the effects to freight movement and operations from decisions regarding the management and preservation of California's pavement network.



Conducting field measurements for transporting tomatoes to a California processing facility to evaluate the connection between road roughness and damaged produce



Caltrans provides a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.

WHAT DID WE DO?

Caltrans, in partnership with the University of California Pavement Research Center, studied the interaction of the pavement-vehicle-freight system through computer simulations, field measurements, and case study interviews with two private firms. The analysis indicated the effects of road roughness, such as damage to sensitive produce, greenhouse gas emissions, route selection and avoidance, tire wear, and vehicle repair and maintenance costs. The researchers developed maps to show the connection of road roughness and the various effects.

WHAT WAS THE OUTCOME?

Caltrans and other agencies can use the data and information to support freight program plans and mandated requirements related to transportation planning. The research results contribute to economic evaluations, identify challenges to the various stakeholders, and explore problems, operational concerns, and strategies that go beyond the pavement. The findings provide input for planning and economic models to calculate the direct effects of ride quality on specific routes and help form pavement policies and strategic recommendations regarding pavement roughness, design, construction, and preservation. The study's investigation of roughness impacts on freight and trucks produced information that enabled one company to perform a benefit-cost assessment comparing the potential cost savings from paying to repair a frequently traveled road instead of accumulating ongoing costs for truck repairs.



Laboratory testing of damage to
tomatoes from imposed vibrations

WHAT IS THE BENEFIT?

Understanding the relationship between roadway roughness and vehicle operating costs, freight damage, and logistics helps transportation agencies evaluate the effects of freight movement on specific routes and use the information to enhance road pavement design, maintenance, and preservation. Private companies can use the data to calculate vehicle operating costs and potential negative impacts on goods caused by specific routes to aid route planning. The data and information supports statewide planning to improve the efficiency of freight transport and support California's economy.

LEARN MORE

To view the final reports for this multiphase study:

Tasks 1-6,

www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2012-06.pdf

Tasks 7 and 8,

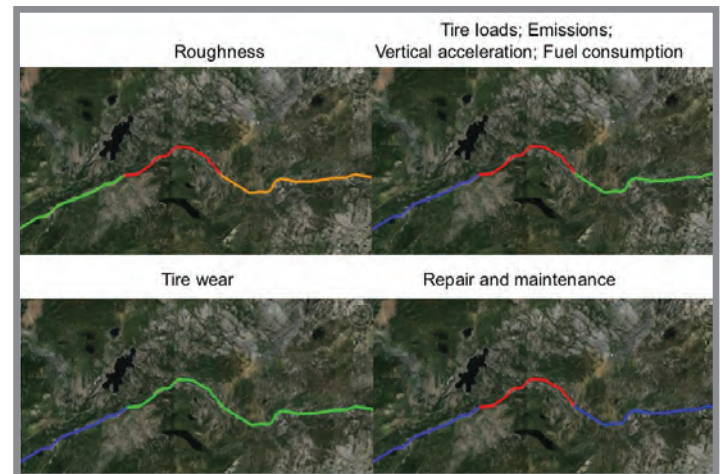
www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2013-08.pdf

Tasks 9-11,

www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2014-01.pdf

For a compilation of the executive summaries:

www.ucprc.ucdavis.edu/PDF/UCPRC-SR-2014-01



Maps show the effect of pavement
roughness on vehicle responses, tire
wear, and repairs and maintenance
Red = Most negative
Orange and Green = Moderate
Blue = Most positive